Effectiveness of play way method for teaching mathematics to children

A

Synopsis submitted

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1. Introduction-

1.1 Poor performance

Academic performance is a term used for students that reflects how they are doing in their studies and classes. Preschool is an important time of child development, both academically and socially. According to Okoye (1982), poor academic performance in children in a learning situation refers to one who fails to attain a set standard of performance in a given evaluation exercise such as test, examination or series of continuous assessment. This means a candidate who scores less or below a given standard is regarded as poor performing academically. In general, the term poor academic performance is a familiar phenomena and a common academic problem of students.

Mathematics relates to everything in this universe from the smallest to the largest. A positive attitude toward mathematics and a strong foundation for mathematics learning begin in early childhood. Improving mathematics learning is of great concern to educators, because early teaching experiences affect later education outcomes. Research-based improvement of performance in mathematics is likely to pay off with increased achievement, literacy and work skills of children in these critical areas.

Mathematics depends not only on cognitive abilities but also on emotional factors and attitudes. Several studies (Baloglu and et.al. 2006) have shown that emotional factors may play a large part in mathematical performance. Thomas and Dowker (2000) and Krinzinger et. al. (2000), found that mathematical performance of 6- to 8-year old children was related to liking mathematics and to self-rating ability in the subject.

Mathematics is helping children to make sense of the world around them and teaching them to reason and problem solve. It's not limited to a specific period or time of day; instead it is a natural part of young children's play and daily activities. They explore mathematical concepts as they sort, classify, compare quantities, and find patterns.

The numerical concepts children acquire in early childhood lay the foundation for learning mathematical concepts. Successful early experiences in math have a powerful effect on the interest and confidence students bring to new opportunities for math learning. Providing carefully tailored individual or small group instruction together with additional practice, explanation and feedback might be sufficient for many students who are lagging behind their peers in learning critical foundational skills in math. Tailoring math instruction in the early years will benefit all children.

Education is imparted for achieving certain ends and goals. Some goals are attached with each subject, which are to be achieved through teaching of that subject. According to Sidhu (1995) the goals of teaching mathematics are to develop the mathematical skills like speed, accuracy, logical thinking, reasoning power, analytical thinking, critical-thinking, ability of decision-making scientific attitude, find and verify results, technique of problem solving, ability to analyze, drawing inferences and generalizing.

Responsible reasons for poor performance in mathematics among children are lack of learning materials like books charts chalks. Munda, et.al. (2000).Methods of teaching, attitude towards mathematics and effectiveness of mathematics teachers is also responsible for poor performance of students. If mathematics teacher's workload is high it may contribute to student's poor performance in mathematics.

Socio economic factors like education background of parents or other family members effect engagement in a student's education and therefore influence the student's achievement (Desarrollo 2007). Low parental socio-economic status is associated with limited resources hence it contributes to lower academic achievement of children. (Conger et al 1992, 1993, 1999).Children who come from insecure environments caused by socio-cultural practices such as cattle rustling, early marriages and female genital mutilation (FGM) show emotional problems at school. They lack concentration in class and confidence in whatever task they are given to do. (Durojaiye 1976).

Personal factors of students like gender, economic factors and attitude towards mathematics, lack of developmental readiness, poor concentration, poor memory, poor coordination and lack of motivation, punishment and verbal criticism also delimit the performance of children

in mathematics. Mwamwenda (1995) argued that the achievement of students in a subject is determined by their attitudes rather than inability to study.

1.2 Basic methods of teaching mathematics

The ideal teacher knows all about his children, how they grow, their needs and capabilities as individual at each stage in their development. He is aware of the fact that they are learning indirectly from their whole environment as well as from his direct teaching and he seeks to make the best use of both means.

it is important for the teacher to first reassured himself of the main objects in teaching, then considers the value of the content of his teaching, distinguish between giving children experience and causing them to learn. Only then can he turn his attention to the methods. Activity is one of the keynotes of modern education, and extension of the use of activity as a technique for teaching has given rise to certain methods of effective teaching as given by Farrant (1964). Which include:

I. Play-way methods
II. The project method
III. Centers of interest method
IV. The assignment system
V. Questioning method

I. **Play-way method:** It helps feebleminded children to learn so well such that they out stripped normal children in public examinations. Newcomb et al, (1994), claimed that a person remembers 90 o\o of what they say as they perform an activity. The method is based on the use of activity purposefully during teaching-learning periods. In such periods, the teacher engages the students to perform an activity that will clarify the subject matter that is being introduced to them. This helps the student to learn and be independent to work harmoniously with other students in the class. It offers opportunities to express himself and gain experience, simultaneously. This method can be used in the teaching of many concepts in mathematics.

II. **The project method:** in this method the teacher assigns particular projects to the students. His task in a project is simply to guide the children as they find the need for his help. He encourages his students by showing a lively interest in their work. The value of the project is determined by the quality of learning shown in the work they produced. It makes learning effective because it helps the children know that they had succeeded. This method also socializes the child because it is a combined effort; each individual contributes his knowledge and skill to the success of group work.

III. **Centre of interest:** This method is based on using a central topic of interest to the students in order to coordinate all their learning for a length of time that may be as short as a few hours or as long as a few days. The skill of the teacher lies in knowing which topic is suited to this kind of treatment. For example post office or functional activities like buying and selling. This method could be used in the study of money, equations, and volumes of objects.

IV. **The assignment system:** In this method, the student is given responsibility for his learning. The teacher prepares assignment in each topic for the students to tackle individually, while the teacher is always available to advise and guide the student in case of any difficulty he may encounter. This method as opposed to project method emphasis on individual, the method has several advantages. It encourages initiative and independence, and provides students with the maximum amount of individual practice. And assignment should always be a task which is within the capability of the student and has some interest for him.

V. **Question method:** This method is based on the ability of the teacher to pose appropriate questions which not only invite but also provoke and ignite students' intuition and thinking. This teaching methodology also encourages interaction and discussions among teachers to jointly shone and criticize and rebuild their teaching practices.

The above methods or any other method, if properly used singly or in combination of two or more would yield desired result in the mathematics teaching-learning procedure. It is important to note that, no matter how effective a method of teaching, its success rate lies greatly on the attitude of the teacher. Negative attitude from the teacher to the student's can cause a permanent damage to their interest in

mathematics. Some teachers are not approachable, hence students find it difficult to seek help thus remediation is not effective because effective means of teaching is lacking (Popoola, 2006). Thus, failure in mathematics continues to pass on from age to age, thus making the difficulty of students in mathematics to be persistent and continuous.

1.3 Play way method

Children love to play and it is their natural instinct. The play-way method was conceived by Froebel (1837). According to Froebel, play is the work of the children. Play way method of learning is a child centric method where the method of teaching is informal and natural to suit the child's interests. Schools who are using play way method believe that learning is best through play activities (Waite 2000). It rejuvenates the children in their leaning. It enhances their learning abilities. Play-way method of teaching give free reign to a child's curiosity and helps a child to grow and bloom.

A child understands his needs and goals while playing. So play can be an effective way of teaching children. It has been proved (Opuni 2006) that maximum amount of learning results while playing games. While playing games the environment is very relaxed, this makes learning interesting and fun. This is the most desirable method of learning for children. The informal and free atmosphere gives the children a chance to learn concepts and ideas. Toys can sometimes become the source of learning of mathematical concepts. Play way methods can be incorporated in the school curriculum for teaching languages, mathematics, social studies etc through a series of activities like songs, free play, gardening, construction activities, mathematical games, checkers, magic squares, puzzles and building blocks. It makes teaching and learning a memorable experience for both the learners as well as teachers. Through play way method teaching of mathematics becomes more lively and interesting. Role plays, projects, theme based learning, field trips, puppetry are a few techniques included in play way method.

Play-Way Method consists of the activities that include a sort of fun or play and give joy to the students. The learning is not just limited to cognitive development, but also for the overall development of the child.

It is now held that teaching a young learner requires a specific set of skills, know- how and technique because their comprehension level and concentration span is very low. Through this method students do not realize that they are learning but in a way they are gaining knowledge through participating in different activities (Clegg, 2007). Playing linear number board games should enhance young children's numerical knowledge (Siegler and Ramani 2008).

When play way method is used it becomes necessary on the part of the teacher to do a lot of planning for skillful execution of lessons with fun. The learning environment became a joyful experience. Relevant teaching learning materials have to be design and prepared learning activities. Activities need to be arranged so as to explain simple concept before complex concepts.

Hence, the play-way method is an effective preschool teaching method that grabs the attention of a child and helps him or her to concentrate on the lesson at hand. The play-way method of teaching encourages to teachers to organize group activities while play a role in improving the socialization of child whose acceptance is effected due to poor performance. Teach through group activities the use of visually appealing demonstrations that are interesting for the child helps him or her to learn.

This method is based on the use of activities purposefully during teaching-learning periods. In such periods, the teacher engages the students to perform activities that will concretize the subject matter that is being introduced to him. It helps the child to learn and be independent to work harmoniously with other students in the class to express himself and gain experience. Some of the play way activities are placed in appendix.

2. Need of the study

Mathematics is vital to the future of the child and national development (Agwagah 2001). Mathematics makes an essential contribution to a good rounded education, playing a vital role in modernization of this civilization. (ACME, 2011a; Vorderman et al., 2011). It is everywhere and affects the everyday lives of people. Mathematics is the foundation of scientific and technological knowledge that is essential in social- economic development of the nation. It emerges from the real world. Mathematics is one of the essential and basic areas of the curriculum which has a wide field of subject matter. The teaching and learning of mathematics is a complex activity and many factors determine the success of this activity. Though mathematics is an important subject and occupies a central position since ancient period, still it has not been the interest of many students. The gaps are found between abilities and achievement. Teaching pattern of mathematics is often not very interesting and pleasant especially for small children. Ideally speaking children should be given quality mathematical experiences in early education. The level of mathematic skills in kindergarten have been shown to be a predictor of ability in mathematics in the future (Locuniak & Jordan, 2008; Ray & Smith 2010). Children with early mathematical difficulties showed poor performance in both verbal and visuo- spatial work memory tasks as well as on language tests and a fluid intelligence test indicating a thoroughly lower cognitive base (Geary 2004 and Baddeley 1997).

Mathematics is a subject which can be evaluated more objectively. There is no chance for favoritism in evaluation. Therefore it can be safely inferred that children show poor performance in mathematics because they do not get interest in learning numeral concepts. Teaching pattern in classroom is often not interesting. however when students are taught through play activities they do not realize that they are learning but actually they are gaining knowledge through participating in different activities (Clegg 2007).When children play with materials such as cards, buttons and blocks, they develop skills in logic. They experiment with counting and sorting things and solving problems. Activities like observing, comparing, working with shapes, sizes, and quantities forms the basis for understanding

maths for all higher-order thinking.

Early learning affects later outcomes, whatever children learn at this stage will affect their career also because economy revolves around mathematics and their weak concepts will effect their ability to earn their livelihood. Mathematics is a discipline that is vital in everyone's life. Children must learn major mathematical concepts in school so that they will be able to use these skills later in life (Sarama and Clements, 2009).The importance of mathematics for employment and day-to-day living in the modern world is increasing, people have difficulty with mathematics because of steady increases in the quantitative knowledge needed to function in many jobs today, including many blue collar jobs (Parsons, Bynner. 1997).

Children feel problems in understanding of mathematical concepts like multiplication, division, size and shape concepts when they taught in classroom in regular way. As discussed earlier, if they learn through play way method they learn in a better way without any pressure and it makes the children happy and gets them interested to learn. Play way methods and activities assist children to develop early numeracy skills.Young children need to experience a lot of 'doing' and 'saying' before they are able to understand numbers.

3. Justification of the problem

Poor mathematical competencies are common among children and result in low grades and difficulties in common day-to-day activities. Among students, about 7% of children have mathematical learning disability and another 10% show persistent poor performance in mathematics despite average abilities in other areas (Clark 2001). Children who show poor performance have deficits in understanding and representing numerical magnitude, difficulties retrieving basic mathematics facts and delays in learning mathematical procedures (Clark 2001). These deficits and delays cannot be attributed to intelligence. Play way method develops interest and motivation in mathematics class because through this method learning becomes interesting and easier.

Early learning affects later outcomes so it is important to teach mathematics in a way that

leads to development of students and understanding of the subjects. Play way method of teaching has always been believed to create interest in subjects as it is activity based that makes abstract concept into concrete concepts. This makes the learning more effective. Since children take interest in play and group activities, this method of teaching can motivate the children to initiate, compete and perform. If mathematics is taught in fun and interesting manner children can begin enjoy learning. Their concepts can become clear, memorable and performance can be improved.

During the early years of life, children learn concepts of size, number, shape, and quantity by play way method. Play way method develops the skills necessary for critical thinking, leadership and concept development. It involves approaches that children will use throughout their lives. When children share materials and play together, they also learn to cooperate, listen to others, stand up for their own ideas, handle frustration, and empathize. So in addition to learning the concepts they also learn the rudiments of social behavior and working in group.

Through play way method they learn to solve problems, think on abstract ideas, remain focused and work diligently and persistently. The play way makes difficult and boring task, delightful and pleasurable. This however does not mean shirking from real work; it is introducing element of happiness and satisfaction into dull and irksome tasks (Bhatia and Bhatia 2012).

Play way method of teaching is an important pedagogical tool for educators. Play is essential to early learning. Play is the main way by which children learn and develop ideas about the world. If learning is to be made memorable experience, fun filled this method probably is suited for children.

In India where large classroom size heavy course load dominates the education scenario teachers remain restricted to finishing the course within the restricted time frame. There is a tendency to attribute these two reasons to failure. The present study hopes to be able to find a fun filled solution which is result oriented as well as motivating to both the teacher and the taught, the focus will remain on development of concepts but the method employed will be entertaining, the teachers will be teaching but it would appear that she is playing with games. The tasks which were repetitive drills will now became fun filled manipulations of

objects and numbers leading to understanding and comprehension.

Thus the researcher intends to perform an intervention study for improvement of performance in mathematics in children through play way method. Hence the proposed statement of the problem is :

Effectiveness of play way method for teaching mathematics to children

4. Operational definitions:

⇒ **Play way method:-**

Play way method of teaching is a child centered informal way method of teaching such that it suits the interest of the child and improves his academic proficiency effortlessly.

⇒ **Teaching:-**

Teaching involves interaction of teacher and students where the objective of the teacher is to impart knowledge or skill to the students.

⇒ **children:-**

Children between age of 4-6 years will be called as children for the present study.

5. Objectives

1. To study the demographic profile of the sample.
2. To study the baseline pattern of teaching mathematic in schools.
3. To develop educative and instructional tools for teachers, mothers and children based on play way method of teaching.
4. Intervention for teaching mathematics through play way method on selected sample.
5. To assess the effect of intervention on mathematics performance of children.

6. To obtain feedback of the intervention programme from children, teachers and mothers.

6. Methodology

6.1 Locale of the study- As the researcher resides in Agra, hence Agra city will be selected as the locale of the study purposively.

6.2 Sampling technique- Selection of the sample will be done purposively.

6.2.1 Selection of schools –The researcher will select one co-educational school purposively having at least two sections of the selected class.

6.2.2 Selection of the subjects-

All the students of both sections will be selected as sample for the study. One section will be experimental group and the other section will be control group. Along with children their mother and teachers will be the subjects for the study.

6.3 Procedure of the study:

- **Exploration phase**

The researcher will study the baseline teaching pattern in mathematics class room in both experimental and control group.

Identification of students will not be done as the entire class will be the subject of the study.

Since educational performance is effected by multidimensional factors, therefore other factors like examination anxiety for mathematics, attitude towards mathematics teachers, self rated mathematics ability and liking of mathematics of children (of both groups) will be assessed using questionnaire.

Focus group discussion will be done separately for mothers and teachers. The objective of focus group discussion will be to assess locus of control, awareness, attitude and practices of teachers and mothers of both experimental and control group regarding poor performance in mathematics.

The responses of mothers and teachers will direct the researcher regarding awareness,

attitude and practices for poor performing students.

- **Pre intervention phase**

The researcher will prepare a play way programme to teach concepts of mathematics to students of U.K.G.

- **Intervention phase**
  - **Intervention with teachers and mothers**

    Mothers and teachers of subjects of experimental group will be educated on the use of **Play way method for teaching mathematics**. This will be done through a power point presentation.

    Before every intervention session with children the researcher will hold an intervention session with mothers as well as teachers and impart training on conducting the play way activity for teaching of the specific skill to children. Intervention will not be done on teachers and mothers of control group.

  - **Intervention with children**

Fourteen concepts of mathematics will be taught by play way method. At least one week, time will be devoted for teaching each of the fourteen concepts by play way method. Thus the total teaching programme for children will be at least fourteen weeks.

The researcher and the teacher will work together for the conduct of play way activities that have been planned for teaching in her collaboration in the class room.

The researcher will obtain regular report from mothers to confirm that they are using the specific play way activity for teaching the mathematics concept. They will be required to give a daily report of time spent on the programme. This reporting will be done on the daily feedback chart prepared for this purpose.

Teaching will take part in regular class but special attention and focus will be done on the subjects.

Intervention programme will not be administered on children of control group.

- **Post- intervention phase**

Performance of the students after learning each concept will be tested at post

intervention and follow up (one week after the concept has been taught) stage.

The post intervention and follow up test paper will be made by random selection of one course teacher for this purpose to rule out any possibility of difference in performance that may occur due to the difference in the nature of question paper. An attempt will be made to have at least one question paper set by each teacher subject of the study.

The performance of the students of both experimental and control group, at post intervention stage will be compared to their baseline score which was used for their selection as subjects of the study.

- **Follow up**

After the one week of completion of intervention a mathematics test having same difficulty level as post intervention test will be administered on the subjects. Fourteen follow up tests will be held in the study.

Intervention programme will not be administered on control group. Assessment of control group will be done on the basis of regular class teaching.

The assessment of strengths and weaknesses of programme will be obtained on the feedback form which will be administered on students, teachers and mothers of experimental group.

6.4 Techniques of data collection:

Questionnaire will be used for the collection of general information and back ground features, exam anxiety for mathematics, attitude toward mathematics teachers of subjects.

Focus group discussion to assess baseline practices and attitudes and awareness of teachers and parents regarding teaching of mathematics.

6.5 <u>Research Tools</u> –

Table. 1 Detail of tools to be prepared for the research

List of tools	
Assessment tools	**1. General information performa** **2. Questionnaires** to assess(children) ✍ exam anxiety for mathematics ✍ self rated ability in mathematics ✍ attitude towards mathematics teachers ✍ Attitude toward mathematics teaching pattern. **3. Focus group discussion** (mothers and teachers) to assess ✍ practices of teaching mathematics ✍ Awareness regarding problems encountered by children with current teaching methods. ✍ attitude toward teaching mathematics **4. Daily feedback chart** to assess consistency of participation by mothers. **5. Feedback on the intervention**
Educative tool	**Power point presentation** ✍ to educate mothers and teachers regarding play way method for teaching mathematics to children
Intervention tool	A program of play way activities for teaching mathematics

Table 2. Detail of concepts, activities and collaborative team for intervention

Concepts	**Activities**	**Collaborative Team**
Counting	Photo and counting activity	Researcher and Parents
Backward counting	Countdown to calendar	Researcher and Teacher
Number names	Number word matching	Researcher and Parents
Addition	Play card method	Researcher and Teacher
Subtraction	Play card method	Researcher and Teacher
Multiplication	Play card method	Researcher and Teacher
Division	Play card method	Researcher and Teacher
Missing number concept	Drawing	Researcher and Parents
Size concept	Button board , how tall they are	Researcher and Parents
Shape concept	Matching halves shapes	Researcher and Teachers
Coin counting	Let's go for shopping	Researcher, Parents and Teachers
Before after between	Number puzzle	Researcher, Parents and Teachers
More than less than	Number puzzle	Researcher, Parents and Teachers
Sorting and categories	Twin game	Researcher, Parents and Teachers

Some more activities may have to be designed to make the program effective.

7. Variables:

A concept which can take on different quantitative values is called variables. The variables selected for the research are:

- **Independent variables -** The variable that is antecedent to the dependent variable is termed as an independent variable. Play way method will be independent variable in the present research.
- **Dependent variables -** If one variable depends upon or is a consequence of the variable is termed as a dependent variable. In present research mathema performance is depended variable.

8. Analysis of data:-

The information on mathematical performance of children will be presented with the help of manifold table and the statistical tools like:

- Arithmetic mean
- Standard deviation
- Chi – square
- Correlation
- Student t- test will also be used to test the significant difference in mathematical performance of children.

9. Delimitations:-

Although the research will be carried with utmost efforts and sincerity yet the research will be confronted with the following delimitations:

- The study will be conducted in Agra city only.
- Support of mother in teaching mathematics to subjects at home will not be monitored.

- Fixed interval schedule will be used to monitor the adoption of play way method by teachers for teaching mathematics in class.

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Appendix

Counting

Concept developed: number sequencing/ counting

Material: pack of 80 cards (1-20 in four colours)
4 coloured marker cards

Participants in activity: individually/ in pairs

Directions:

Four coloured marker cards are placed at the side and the rest of the cards are kept face down in rows of equal length. The player turns over one card and places it in the correct sequence in the row that has the matching coloured marker card and gives the second player the card that is already in that spot. The second player places that card in the correct sequence in the row that has the matching coloured marker card and gives the first player the card that is already in that spot. Play continues until all the cards are in the correct sequence in the correct colour row.

Variation 1: Use a smaller set of numerals (e.g. only 1 to 5)

Variation 2: Have the players place the cards in a backward sequence.

Addition

Concept developed: addition

Material: 4 sets of number cards (0 to 20)

Participants in activity: in groups of 2 to 4

Directions: Each child is given three cards and the rest of the cards are placed in a face down pile.

The first child picks up a card from the pile and checks to see if he is able to make 20 and still discard one card. If he cannot, he discards a card (face up) and child two picks up a card from the face down pile or picks up the top card in the discard pile. The first child to make 20 wins.

Variation 1: give eight cards to each child and try to make as many combinations that make 20 as possible. Combinations can be put down as soon as they are made. The game ends when one child has no cards left after discarding one and putting down the combinations to 20. Winner has the most sets to make 20.

Variation 2: Change the target sum to a number between 10 and 20.

Backward counting

Concept developed: backward counting

Material: 9" x 12" chart paper,

Red & green construction paper, cut into 1 ¾" x 2" squares

Scissors

Glue

Glitter (optional)

Pen

Index cards, cut into strip

Participants in activity: 2- 4

Directions:

Draw a table with 4 rows and 5 columns on a piece of 9" x 12" chart paper. Divide the table into 2-inch squares.

Measure a table onto a piece of green and red construction paper using the same dimensions. Cut out the squares from each sheet.

Number the colored squares from 1 to 30 (or up to however many days are left before diwali). Alternative is to use glitter and glue to create the numbers.

Glue the colored squares onto the poster board, beginning with the number 30. Apply some glue around the sides and bottom of each square and place them on the poster board in descending order. (Be sure to leave the top part of the square unglued as this will create a pocket or opening to insert the activity).

Cut several sheets of index cards into strips, about 1.5" wide, where an activity will be written for each day.

Number puzzle

Concept developed: before and after,

more than less than

Material: One set of 1 to 100 cards

One set of numbers 1 to 100

One chart paper

Participants in activity: Group of two to four

Directions: Each child picks up 7 numbers and places them in front of him or herself so that they are not visible to the other children. Each child in turn places a number anywhere on the chart. In the next, and all other rounds, the number must be placed beside, above, or below one of the numbers already on the chart. If the child cannot place a number then another must be drawn from the pile and play passes to the next child.

The first child to put all of his or her numbers on the chart is the winner.

Button Board

Concept developed: concept of shape, size and numbers.

Material: Cardboard (12" x 18", or larger)
Paint
Paintbrushes
Buttons
String, yarn or rubber bands
Glue

Participants in activity: individually/ in pairs

Directions:

Paint and decorate one side of the cardboard with paints. Allow the paint to dry completely.

Place out the buttons in straight rows across the cardboard. Stick them in place with glue.

Cut different lengths of yarn, or string and tie them in a knot at the end, creating loops of various sizes.

Children explore different shapes on board by wrapping the looped yarn or string around various buttons.